



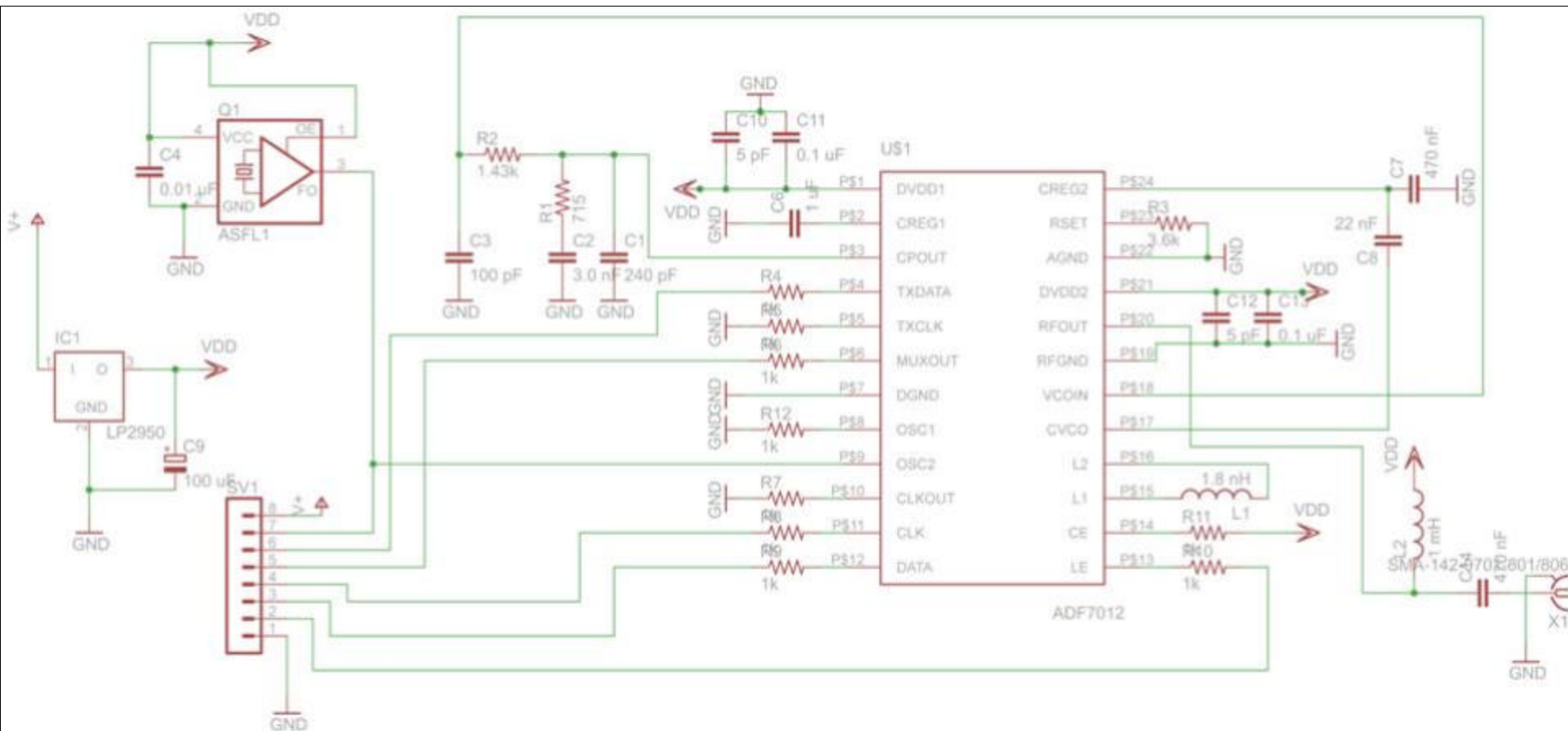
Lecture 10

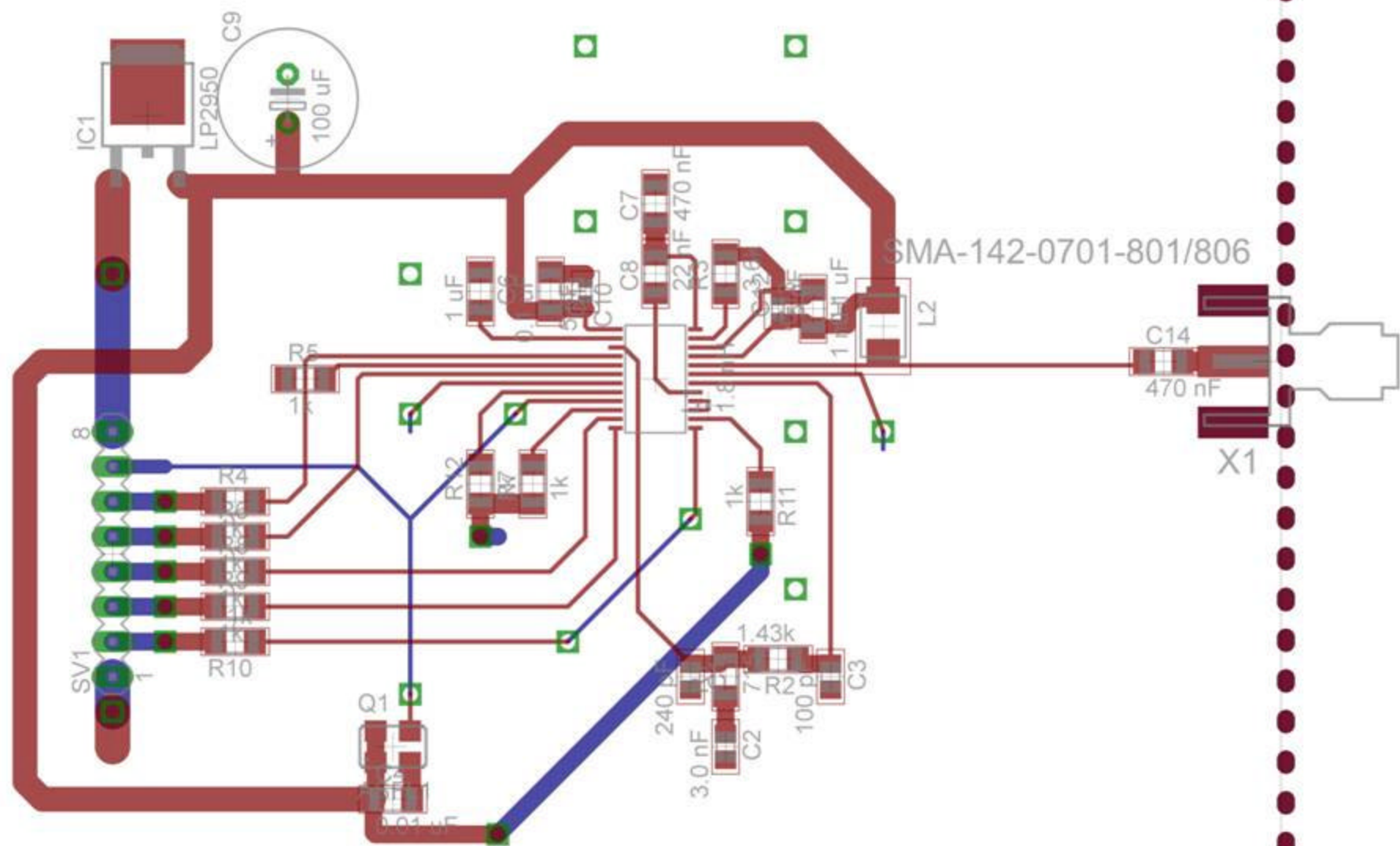
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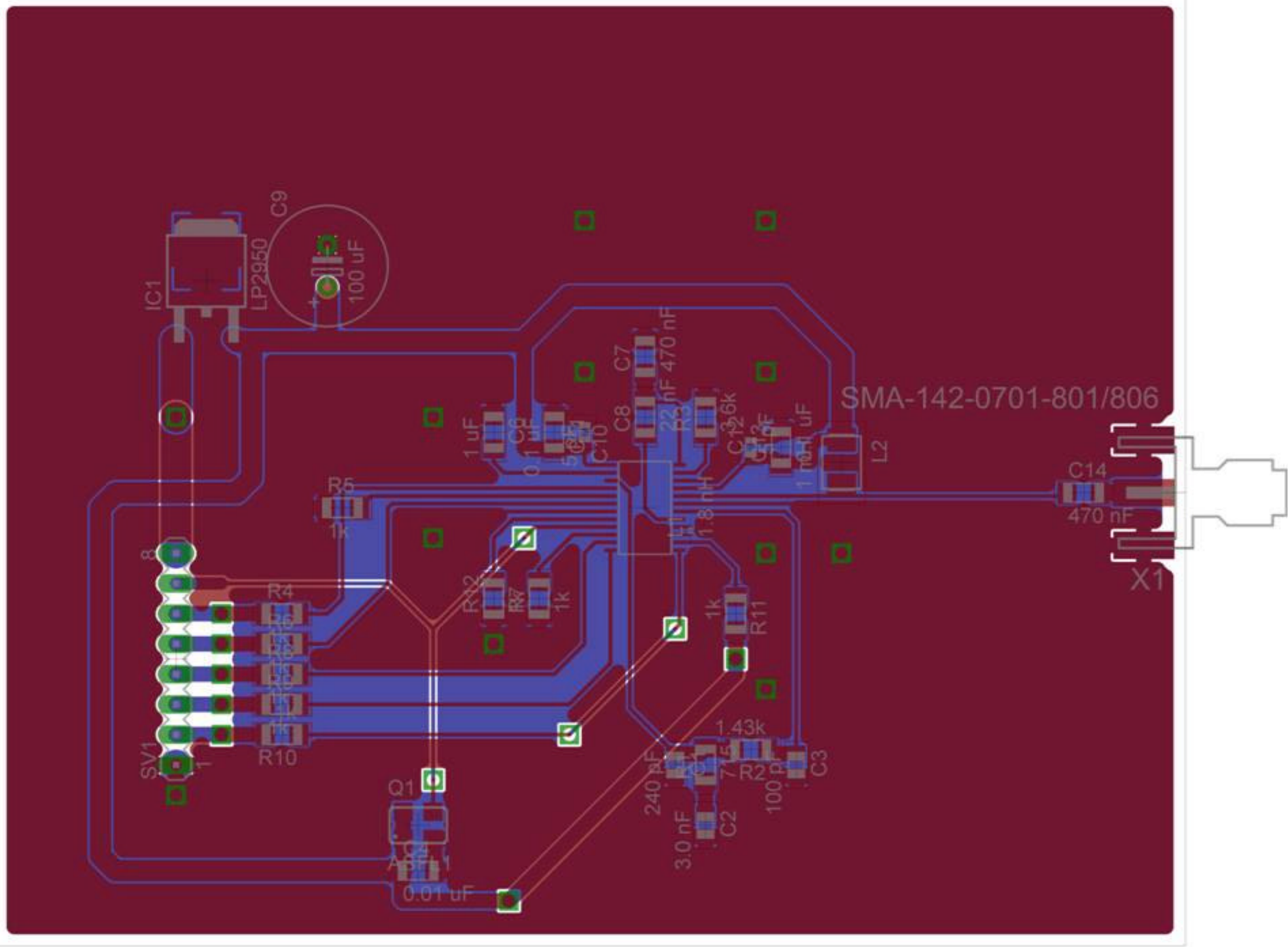
ECE Culminating Design Project

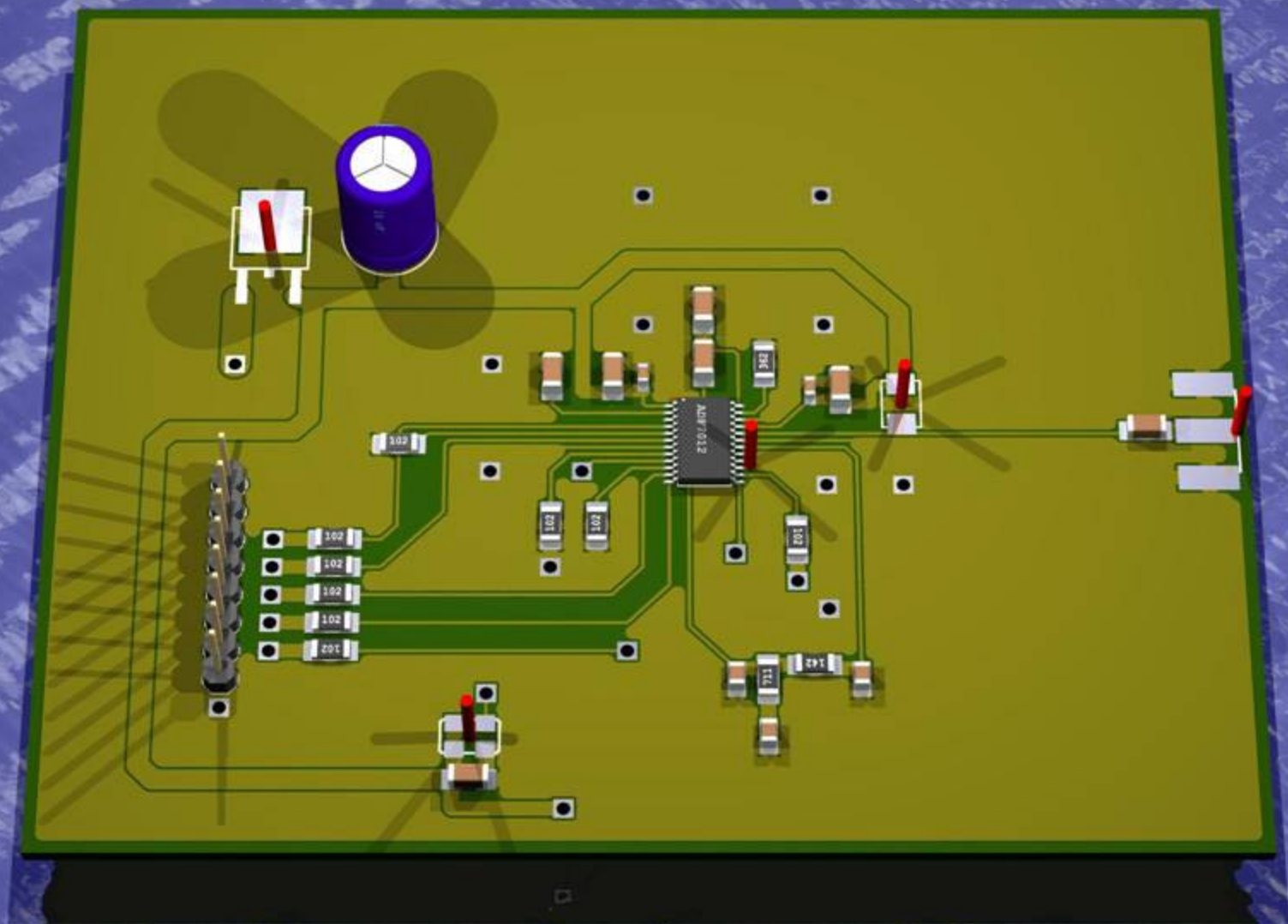
Preliminary Design Review

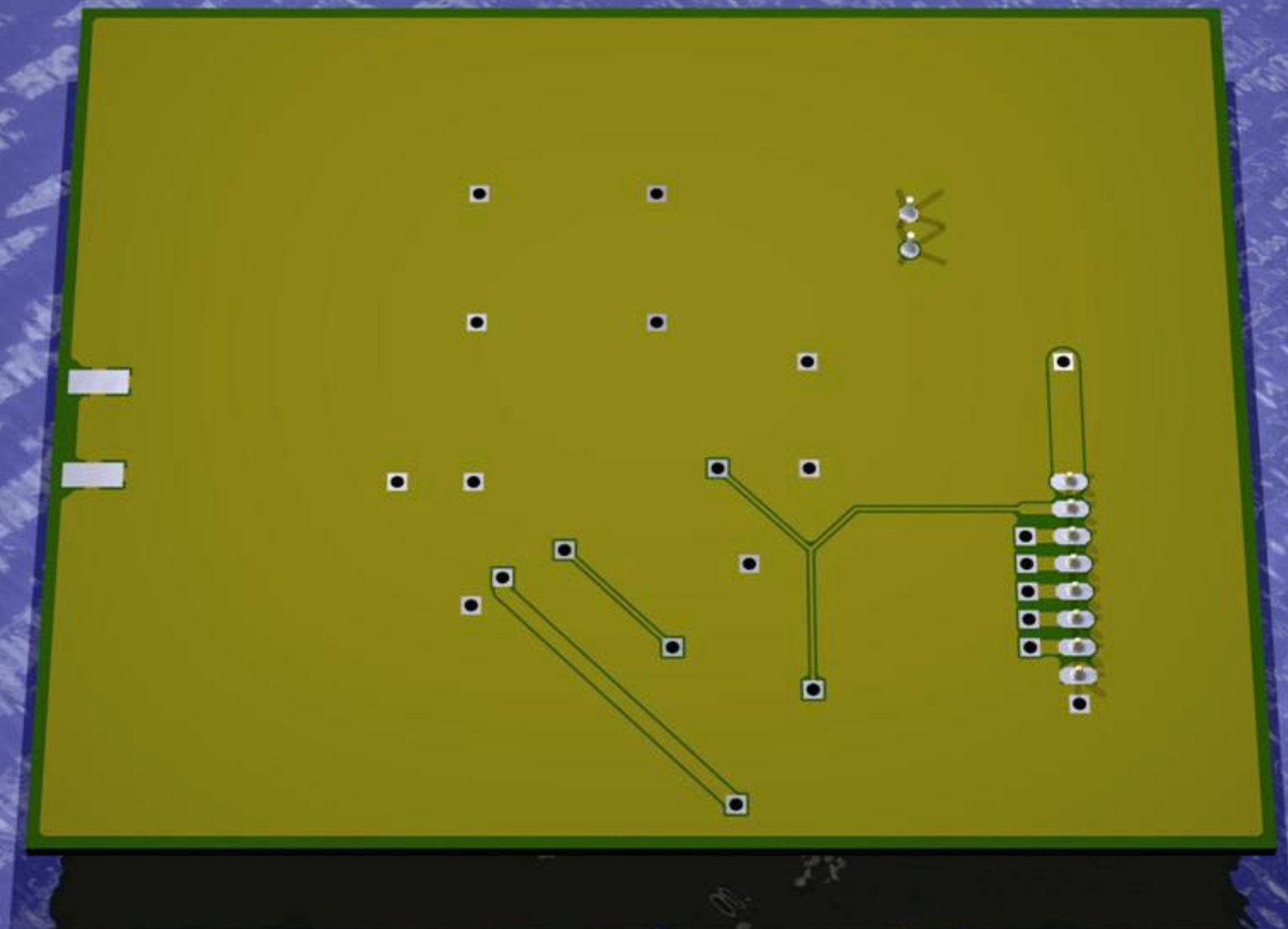
2009 September 23

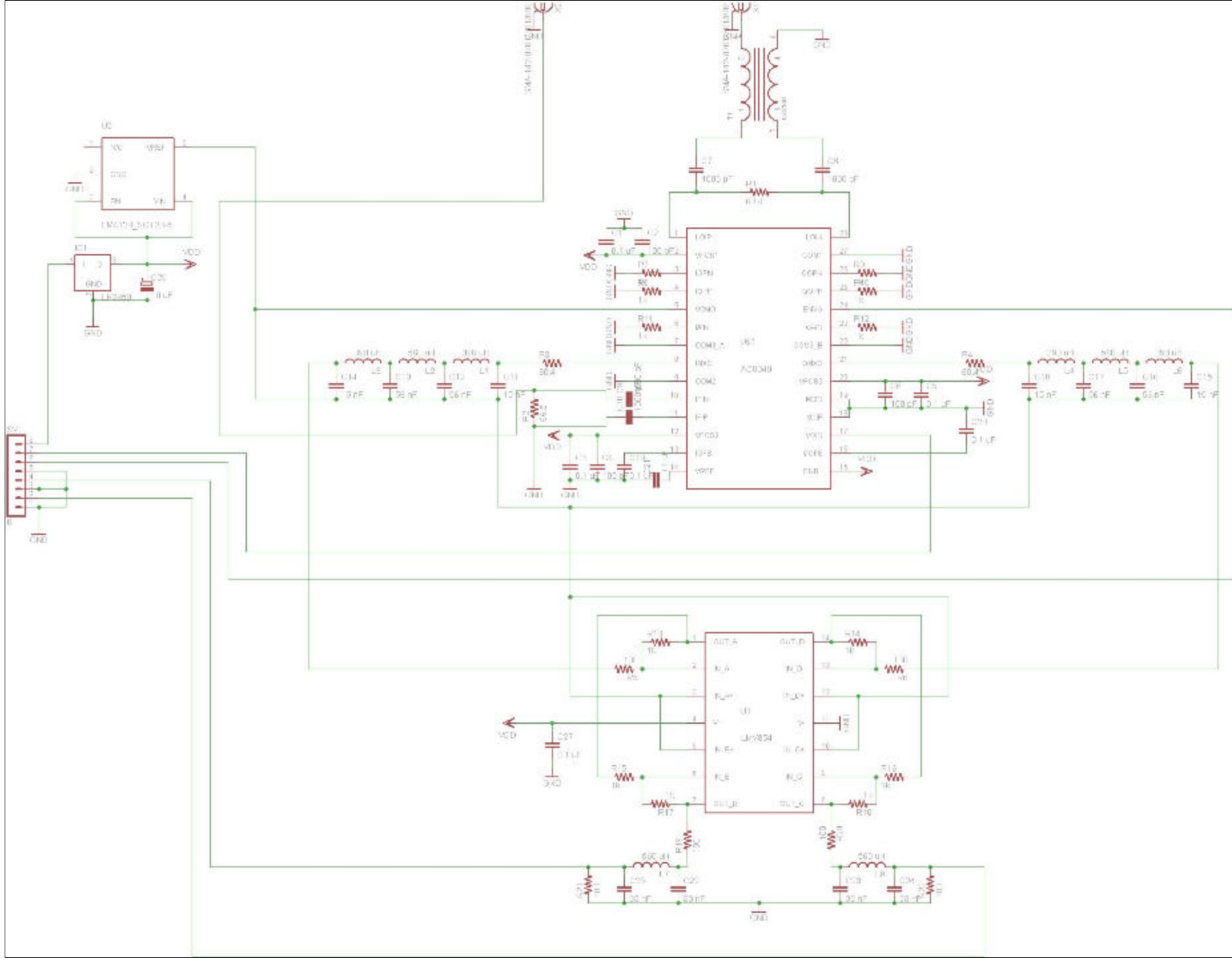


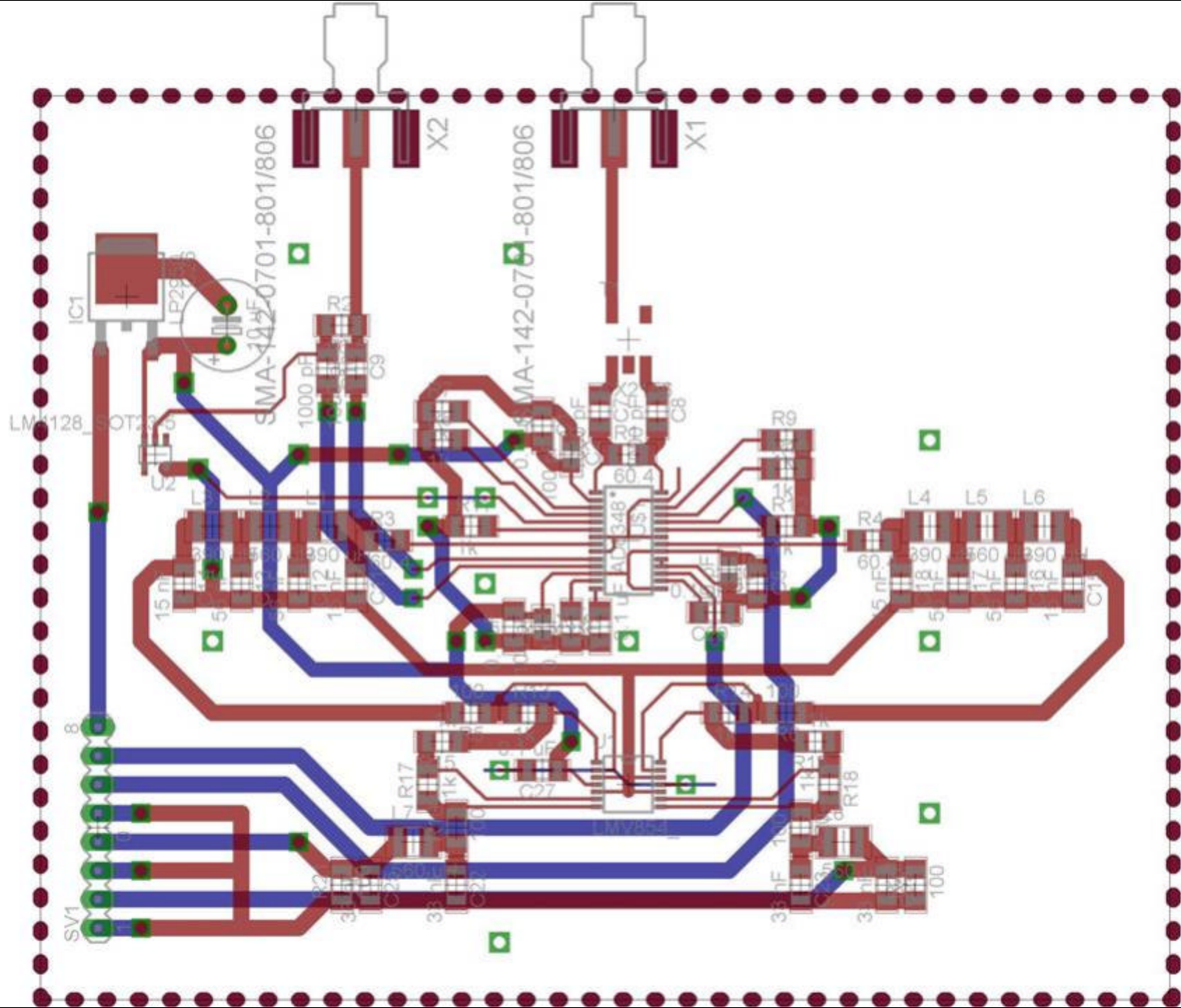


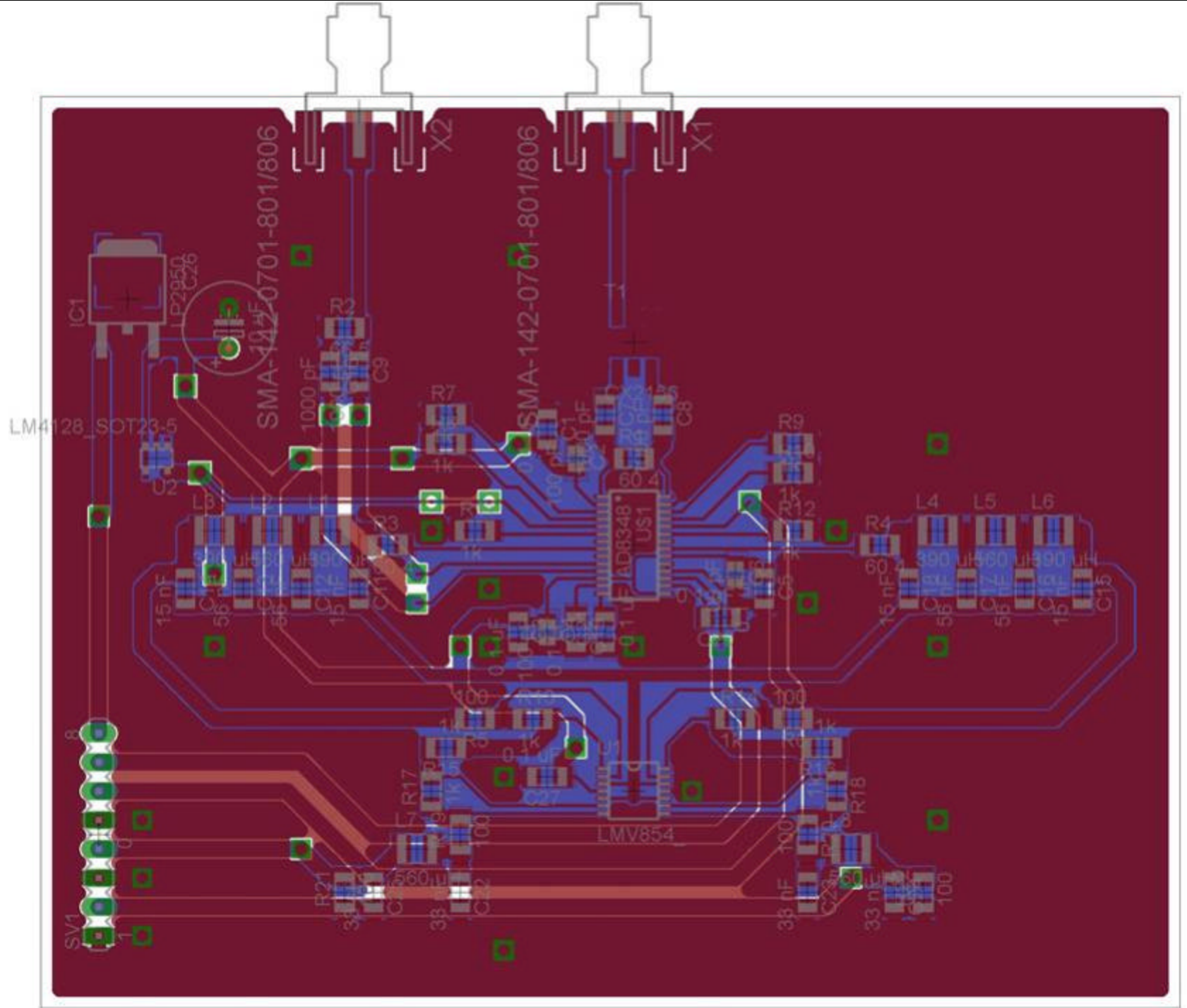


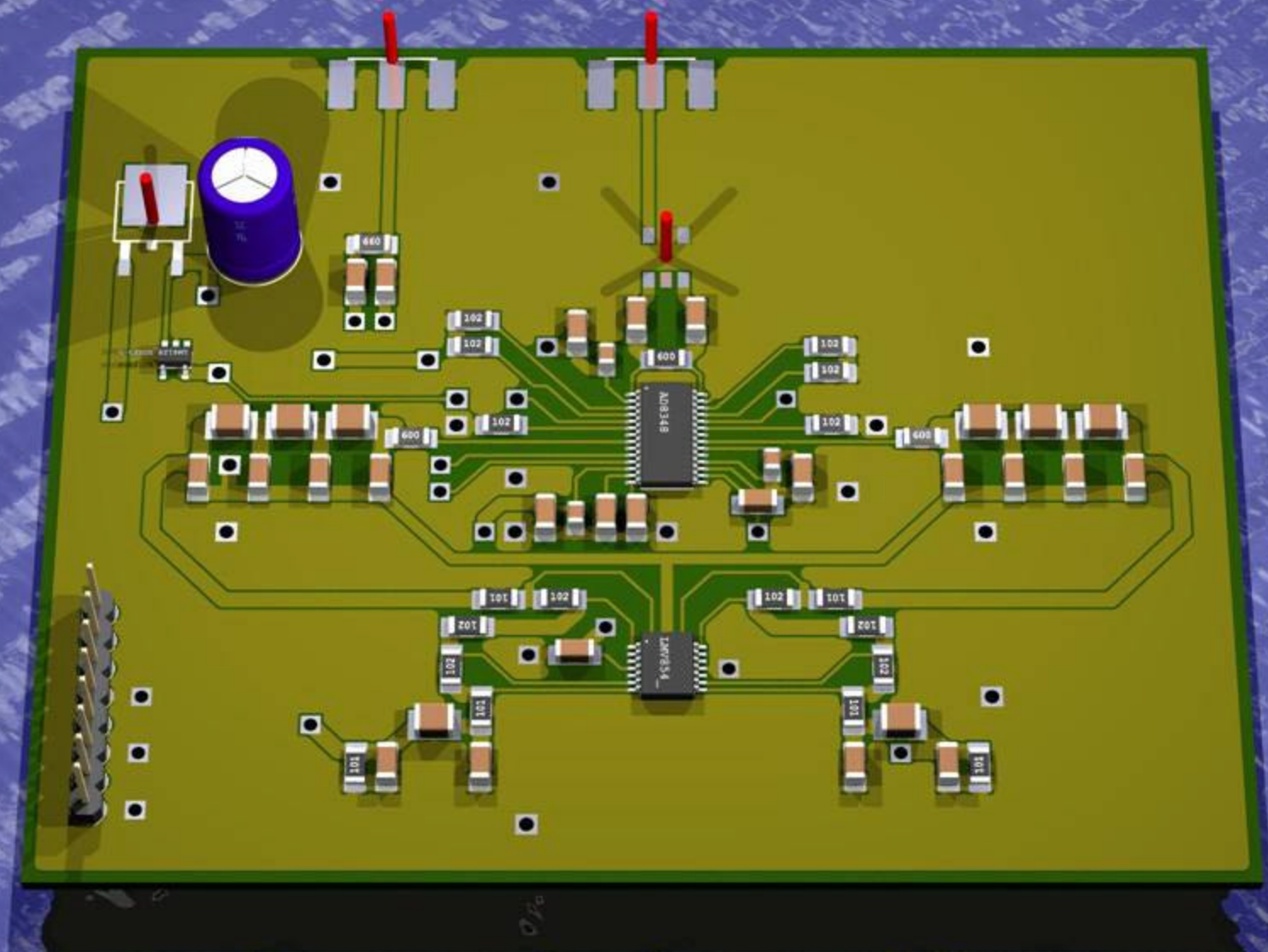


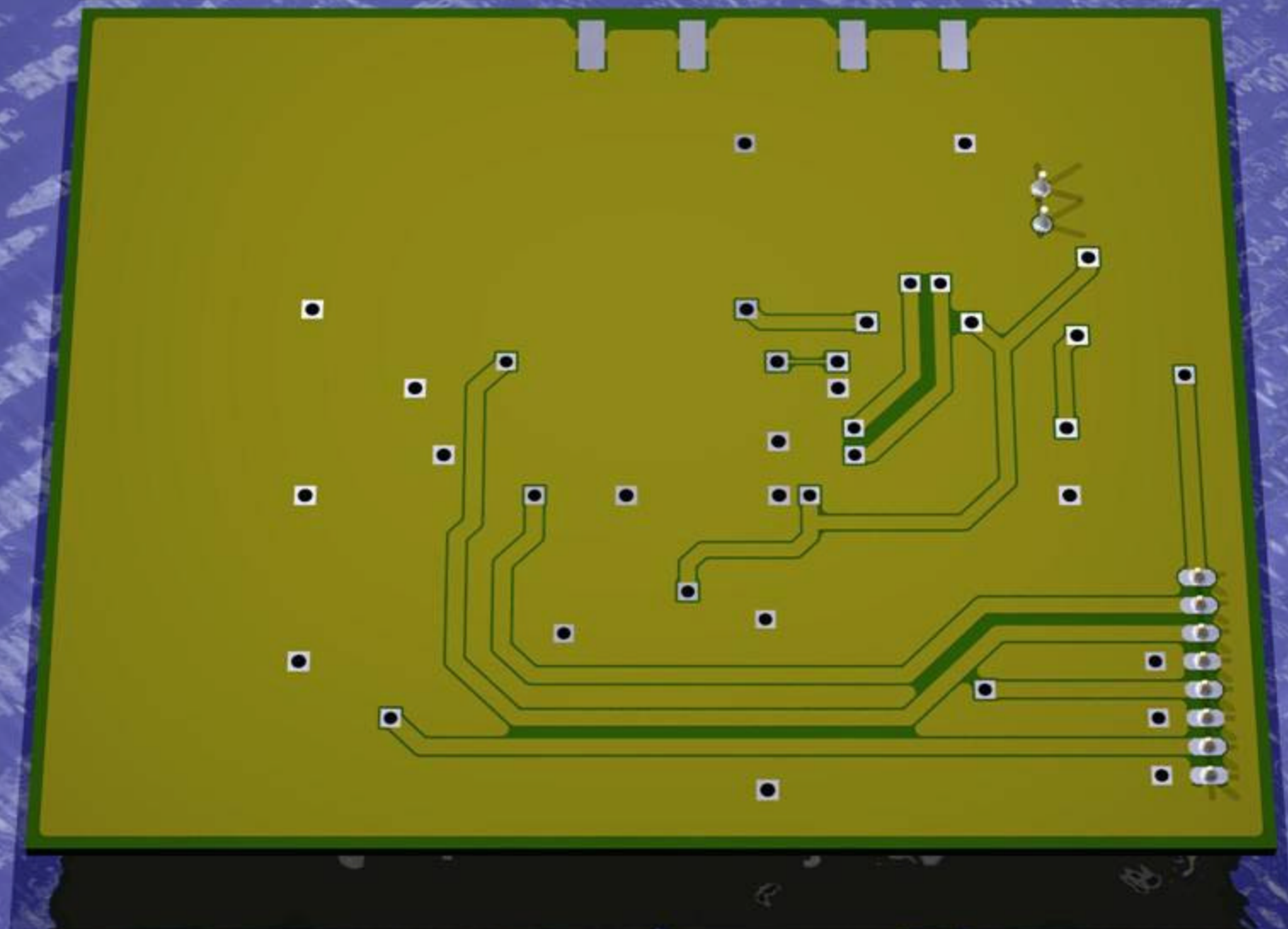












What is due by midnight?

Tonight

Each group's Weekly Report

Each group's web site with
TRPs & Proposal

Fall Break

October 3-6

You are welcome to work on your projects

Preliminary Design Review (PDR)

Finish by October 23

Details specific to your Project Advisor and section

Graded jointly by your Project Advisor and UPCP

Some projects (e.g. externally sponsored)
may present in different venues

Preliminary Design Review (PDR)

Recommended Presentation Content	Proposal Report September 15	Design Review Presentation By 24 October	Final Presentations Dead Week
1. Qualitative Project Goals (brief)	X	X	X
2. Quantitative Project Specifications	X	X	X
3. Background Research: State of the Art	X	audience relevant	X
4. Status	X	X	X
5. Schedule (GANTT or similar chart)	X	X	X
6. Budget	X	X	X
7. Results			X
Highlights:	Contrast candidate paths and commit	Status	Results with contrast to proposal
Duration		<10 minutes	< 15 minutes

Preliminary Design Review (PDR)

Common Industrial Practice

- Primary purpose is a thorough technical review
 - Convince whomever is funding your project that:
 - The design is sound
 - You are making reasonable progress
 - A favorable outcome is likely
 - Review specifications, particularly any changes
 - Give an in-depth review of the design approach and details
 - Review plan for demonstration and acceptance testing
- Other purposes:
 - Review project tasks and schedule
 - Present marketing and cost analysis if appropriate
- The PDR convinces your funding source to keep on supporting you
- An unsuccessful PDR outcome is project cancellation
- Should be optimistic but realistic
- Don't cover up problems!

PDR Presentation Guidelines

- Presentation must be in PowerPoint (not a PDF)
- Every team member must give a non-trivial part of the presentation (several minutes)
- Your audience for the presentation is company management (including technical management) and engineering peers who will be evaluating your progress
- You need to convince management that your project is worthy of continued support and that any problems are understood and under control
- Your presentation should include **graphical information** such as block diagrams, screen layouts, flow charts, etc. and not just text
- Should clearly indicate current project status

Preliminary Design Review (PDR)

Christina Bourgeois will be visiting our lecture to discuss presentation issues.

General to Specific

- You cannot show your entire project at a fully detailed level of abstraction.
- You are the ones who select what specifics to show.
- Choose what is relevant to the point you are illustrating, & your audience.
- You are demonstrating your creativity.

Presentation Styles

MTV

Versus

1950's TV News Broadcast

Presentation Styles

Quick cutting between images,
often with handheld cameras,
is typical fare for your generation.
(e.g. the contemporary *Bourne* movies)

This is maddening to many older folks.

The older folks are probably paying you.

Post Group Photos with Names

Name the file

groupphoto.jpg

and place it in your home page directory
within a week of your PDR presentation.

Practice

Practice Prevents

- exceeding your time limit
- temptation to read from the screen
- anxiety, embarrassment, & shame

Q&A

Repeat the questioner's question.

The best responses sound like enthusiastic replies to a respected peer. Authenticity is a winner.

Do not start waffling, babbling, crying...

Do not lie. Just, don't.

The result is a total loss of credibility.

If you do not know, it is acceptable to say effectively:

"...I do not know but shall find out and get back to you..."

Brent's Q&A 1:05/1:22

Project Documentation for the PDR

- A PDR presentation cannot properly show all needed project documentation
- A supplementary documentation package may be required (check with your project advisor)
- Should convey technical details beyond the scope of a presentation such as:
 - Detailed schematics
 - Mechanical drawings
 - Screen layouts (GUI details)
 - Detailed block diagrams and flow charts
- Ask your Advisor: Is a hardcopy package required at presentation time?

Project Documentation

A critical aspect of your final project deliverables
(& supporting your PDR for some Project Advisors).

Types of Project Documentation

- System (High) Level
 - “Big picture” block diagrams
- Detail (Low) Level
 - Electrical schematics, mechanical drawings
- Interconnections
 - How different modules are connected
- Software
 - Flow charts, commented source code
- End User (Customer) Documentation
 - Operator’s manual, maintenance manual, etc.
- General Project
 - Document the design process

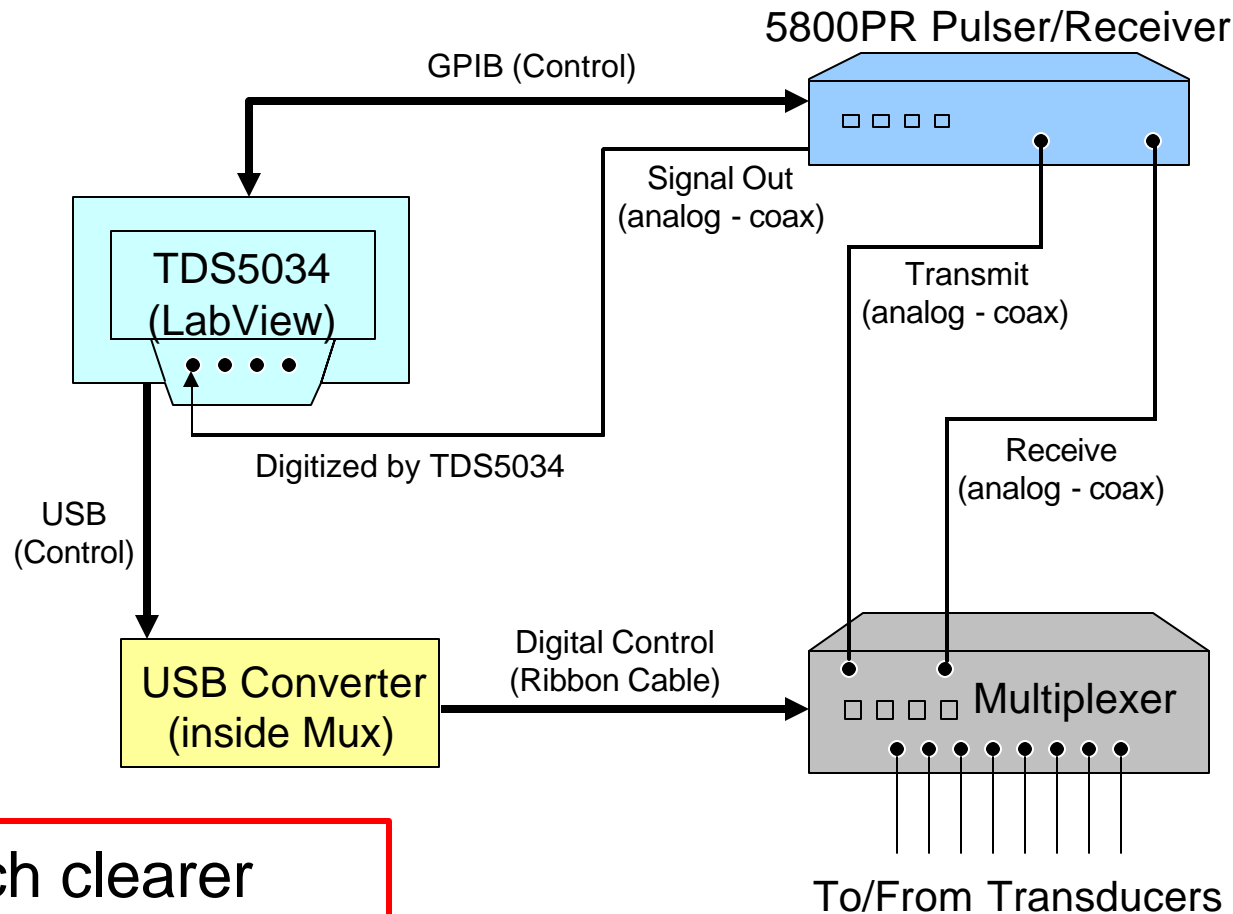
High Level Block Diagrams

Needed for every report and presentation

Previous Example – System Description

- PC-Based Oscilloscope (TDS5034)
 - Controls multiplexer via USB interface
 - Controls pulser-receiver via GPIB interface
 - Runs LabView
- Pulser Receiver
 - Signal output goes to scope input and is digitized
 - Transmit and Receiver are connected to the Mux
- Eight Channel Multiplexer
 - Supports up to 8 transducers
 - Routes Transmit and Receive to/from transducers
 - USB interface with scope PC

Previous Example – System Block Diagram



- Much clearer
- More information

Would you rather:

Look at a Block Diagram
or
Read a Text Description?

High Level Block Diagrams

Needed for every report and presentation

- Show functional elements – these are not necessarily physical elements, although they often are
- Clearly label each element
- Indicate interconnections and connectivity type (e.g. analog, digital, data bus, etc.)
- Label all interconnections
- Use arrows to show directionality

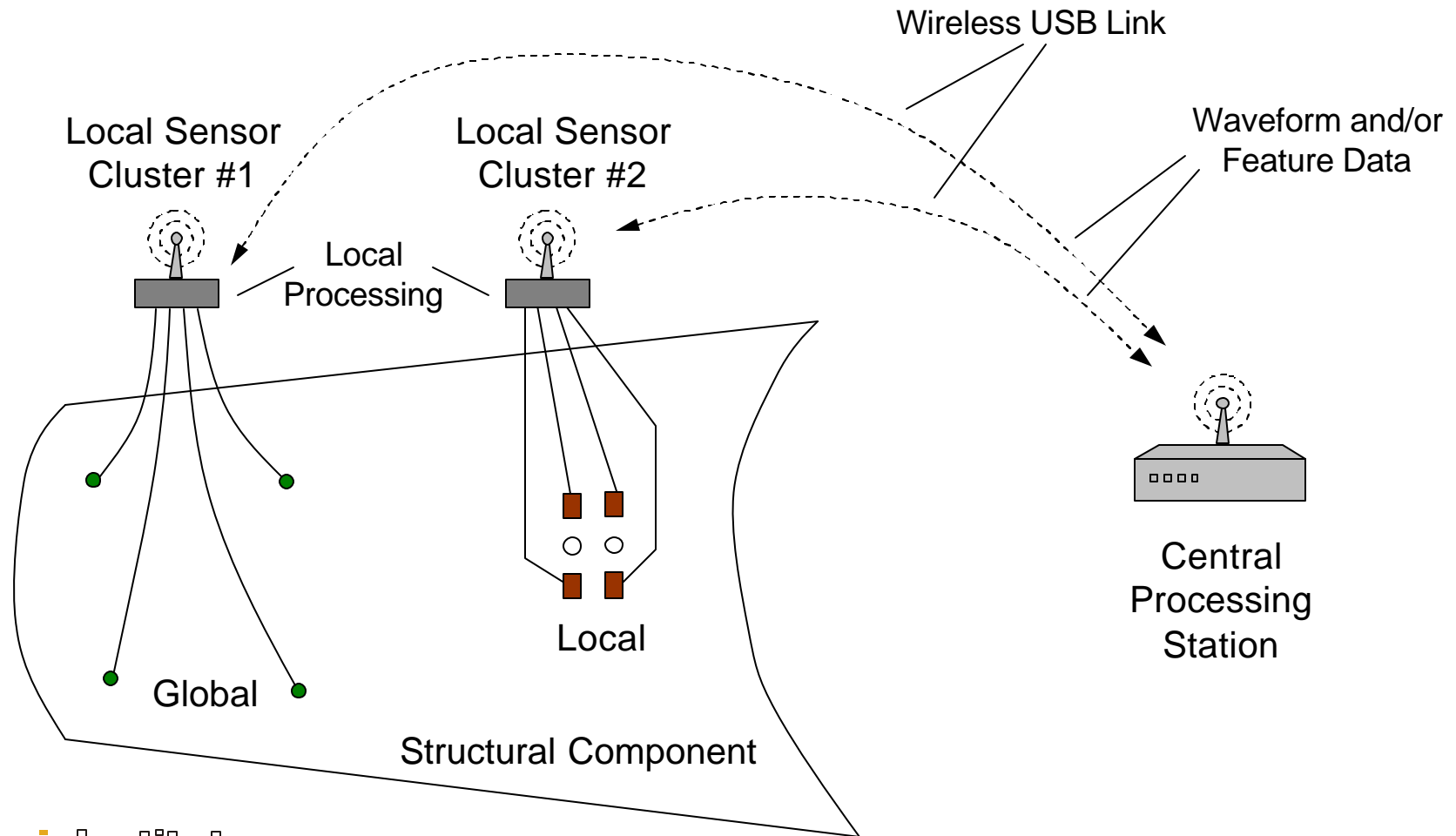
Example – System Description

Ultrasonic Structural Health Monitoring System

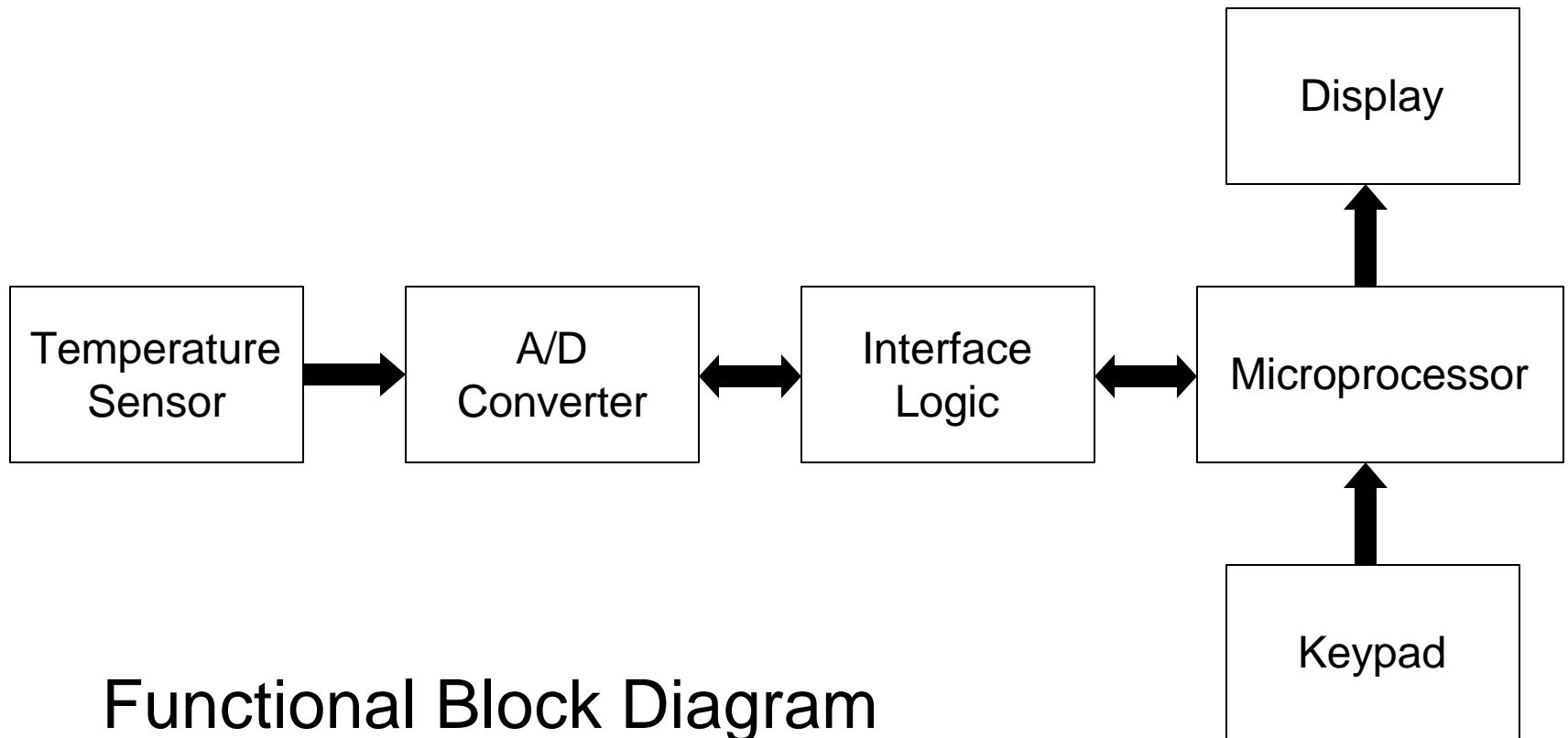
- **Sensor Cluster**
 - Multiple ultrasonic sensors (up to 16 per cluster)
 - Each sensor can operate as a transmitter or a receiver
 - Synchronization between all sensors in a cluster
 - Processing capabilities for local data analysis
- **Structure with Multiple Sensor Clusters**
 - Local sensors for monitoring small areas
 - Global sensors for monitoring large areas
- **Wireless Link**
 - Sends raw waveforms or processed data to base station
 - COTS USB link (2.4 GHz)
- **Base Station**
 - Further processing of data
 - Can link/combine data from multiple sensor clusters

Example – System Description

Ultrasonic Structural Health Monitoring System



Temperature Monitor



Functional Block Diagram

Electronic Files

- Mechanical drawings
- Electrical/electronic schematics
- Software source code
- Project planning charts

Use a version/revision scheme for naming files, and on all title blocks and software headers. Date and keep a chronological record of revisions.

Typical ANSI Standard Title Block

ANSI = American National Standards Institute

The diagram illustrates a typical ANSI Standard Title Block layout. It features a large central area for the drawing, surrounded by a title block. The title block is divided into several sections:

- Revisions:** A table at the top right with columns for ZONE, REV, DESCRIPTION, DATE, and APPROVED. A blue arrow points to this section with the label "List of revisions".
- File information:** A section on the left side containing fields for FNAME, REVD, and USER. A blue arrow points to this section with the label "File information".
- Title:** A large central field for the drawing title. A blue arrow points to this field with the label "Title".
- Drawing number:** A field for the drawing number. A blue arrow points to this field with the label "Drawing number".
- Revision letter:** A field for the revision letter. A blue arrow points to this field with the label "Revision letter".
- Bottom Section:** A section at the bottom containing fields for SIZE, PSCM NO., DWG NO., and SHEET. A blue arrow points to this section with the label "List of revisions".

Arrows indicate the flow of information and the relationship between the drawing and the title block.

Electrical/Electronic Schematics

- Physical layout:
 - Show components, I/O connectors, and interconnections between circuit blocks
- Parts list:
 - List all procured parts and vendors
 - Numbers assigned must agree with physical layout and schematics
- Schematics:
 - Label components with part numbers, values, and identifier numbers (e.g. U1, U2, R1, R2, ...)
 - Label all I/O connectors and interconnections between schematics
 - Try to make signals “flow” from left-to-right and top-to-bottom (inputs on left/top, outputs on right/bottom)

Schematic Example

VHF Pre-Amplifier: Ramsey PR-20

Units:

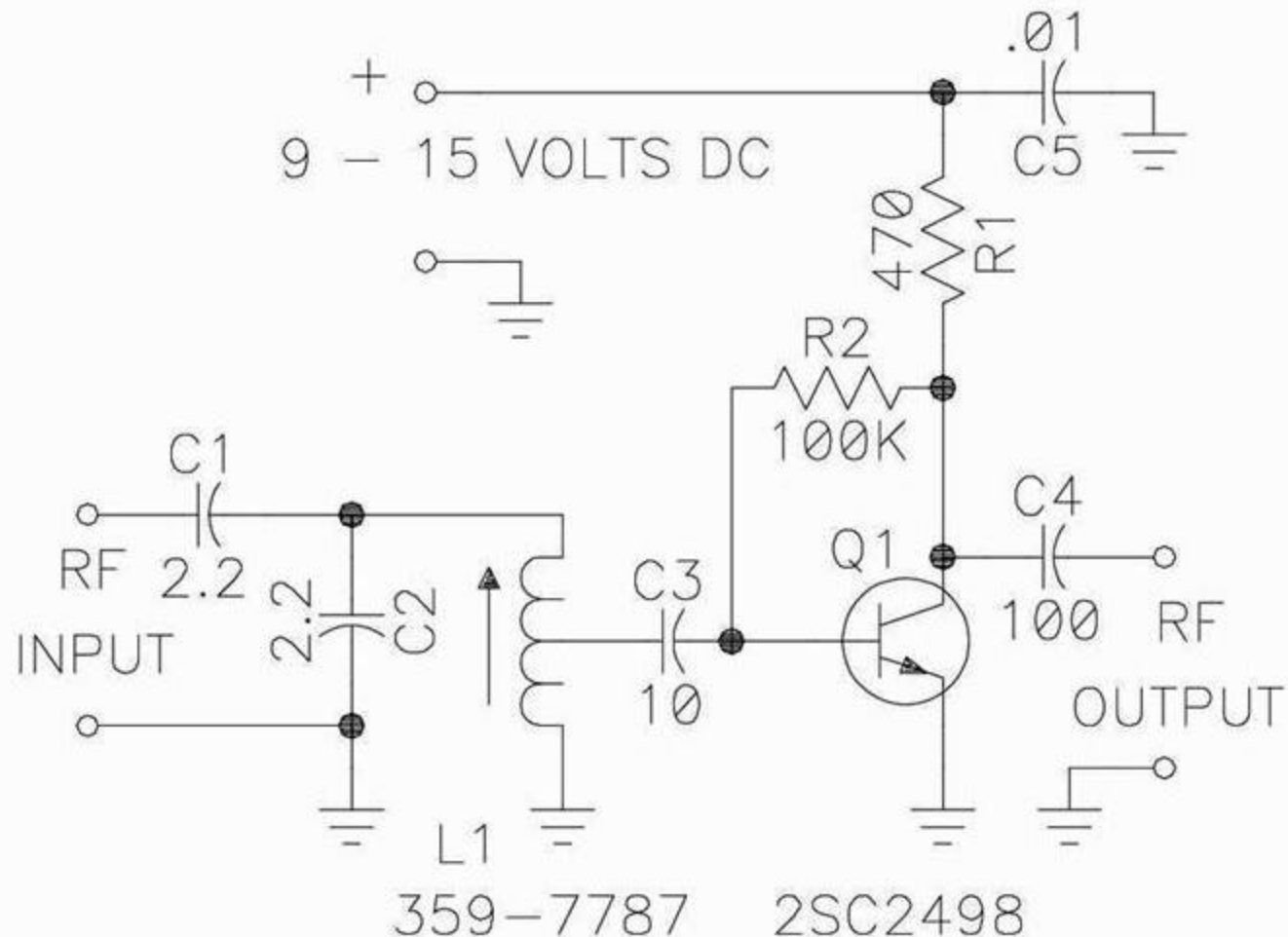
Capacitors

Resistors

Signal Flow

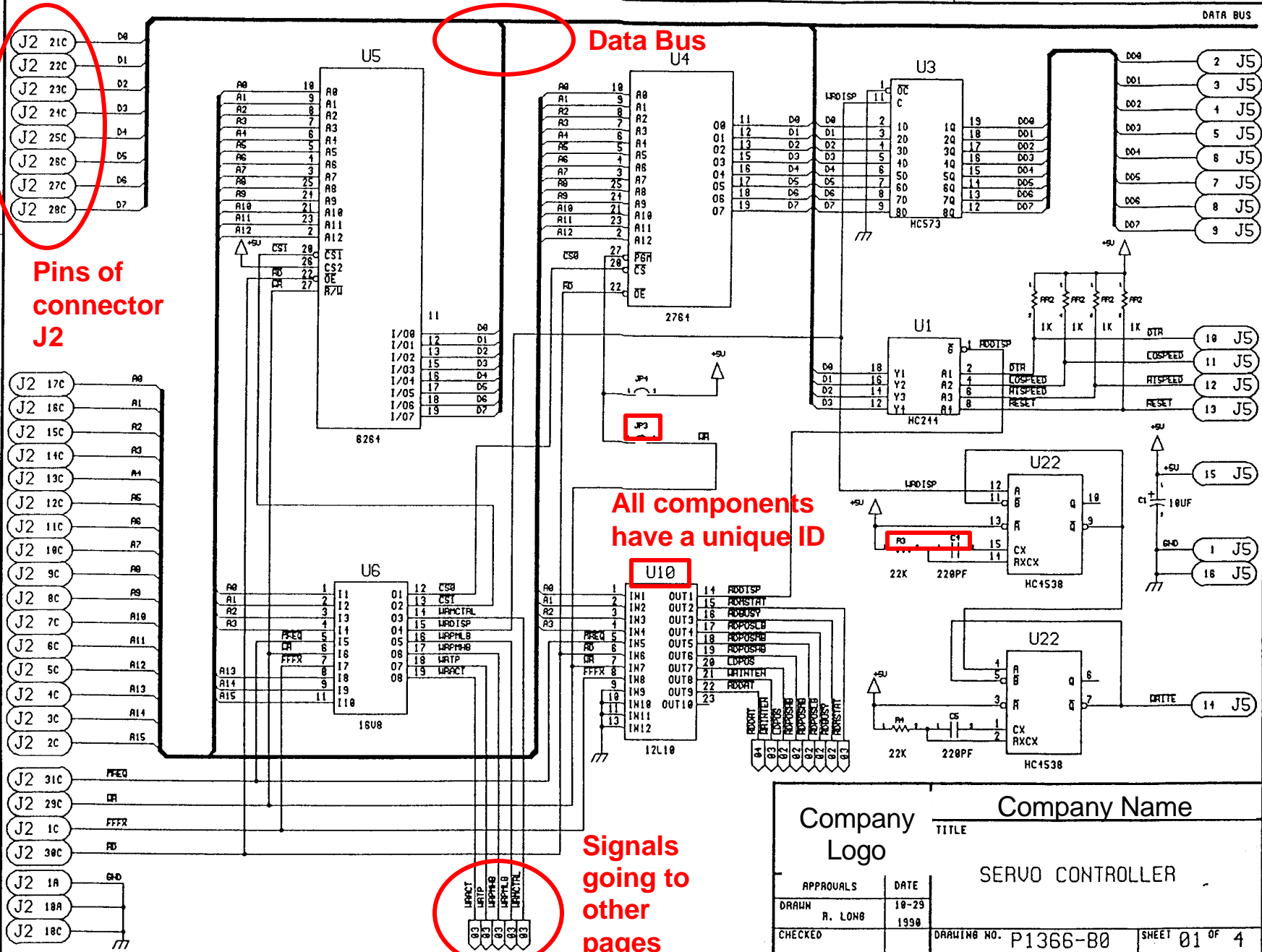
Power Flow

Inductor Arrow

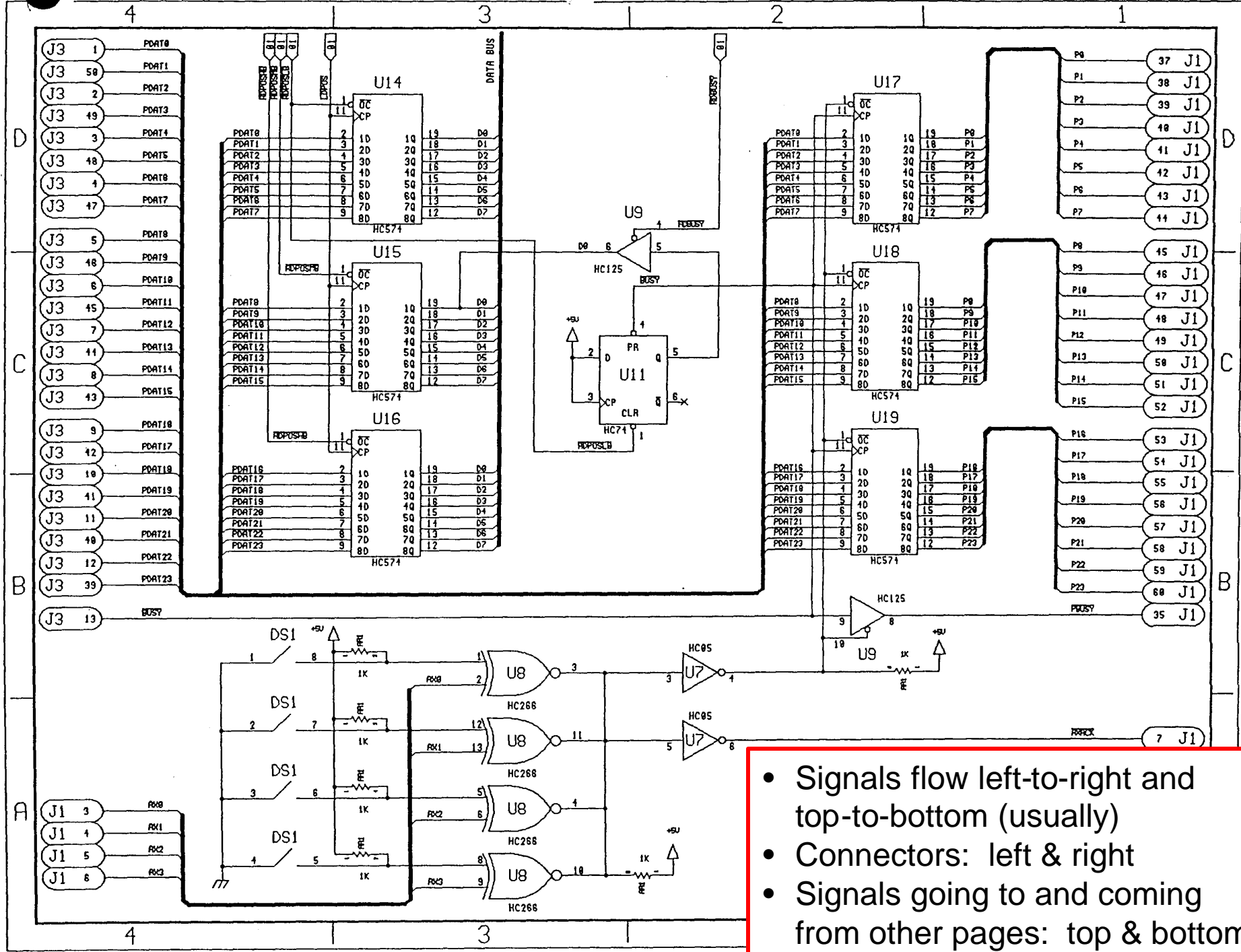


Complex Schematic Example

- Servo controller board
 - Multi-page schematic
 - Component overlay
 - Silkscreen overlay



Company Logo		Company Name	
APPROVALS		TITLE	
DRAWN R. LONG		18-29	
CHECKED		1998	
DRAWING NO. P1366-80		SHEET 01 OF 4	



- Signals flow left-to-right and top-to-bottom (usually)
- Connectors: left & right
- Signals going to and coming from other pages: top & bottom

4

3

2

1

D

D

C

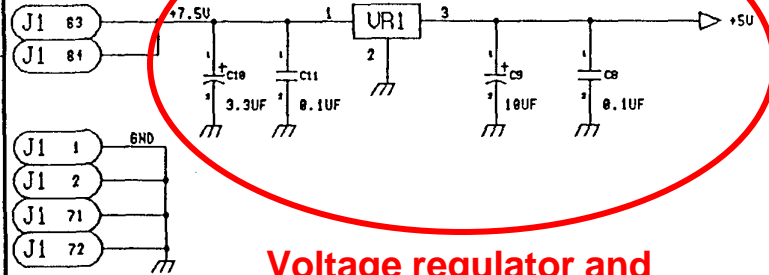
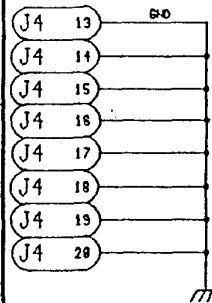
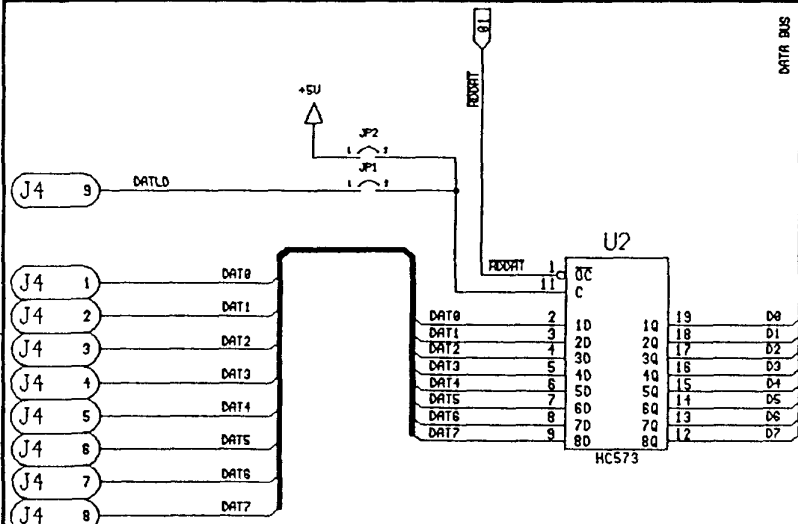
C

B

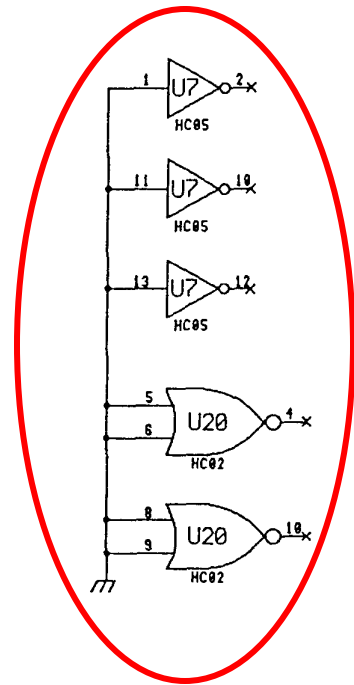
B

A

A



**Voltage regulator and
decoupling caps**



Unused Gates

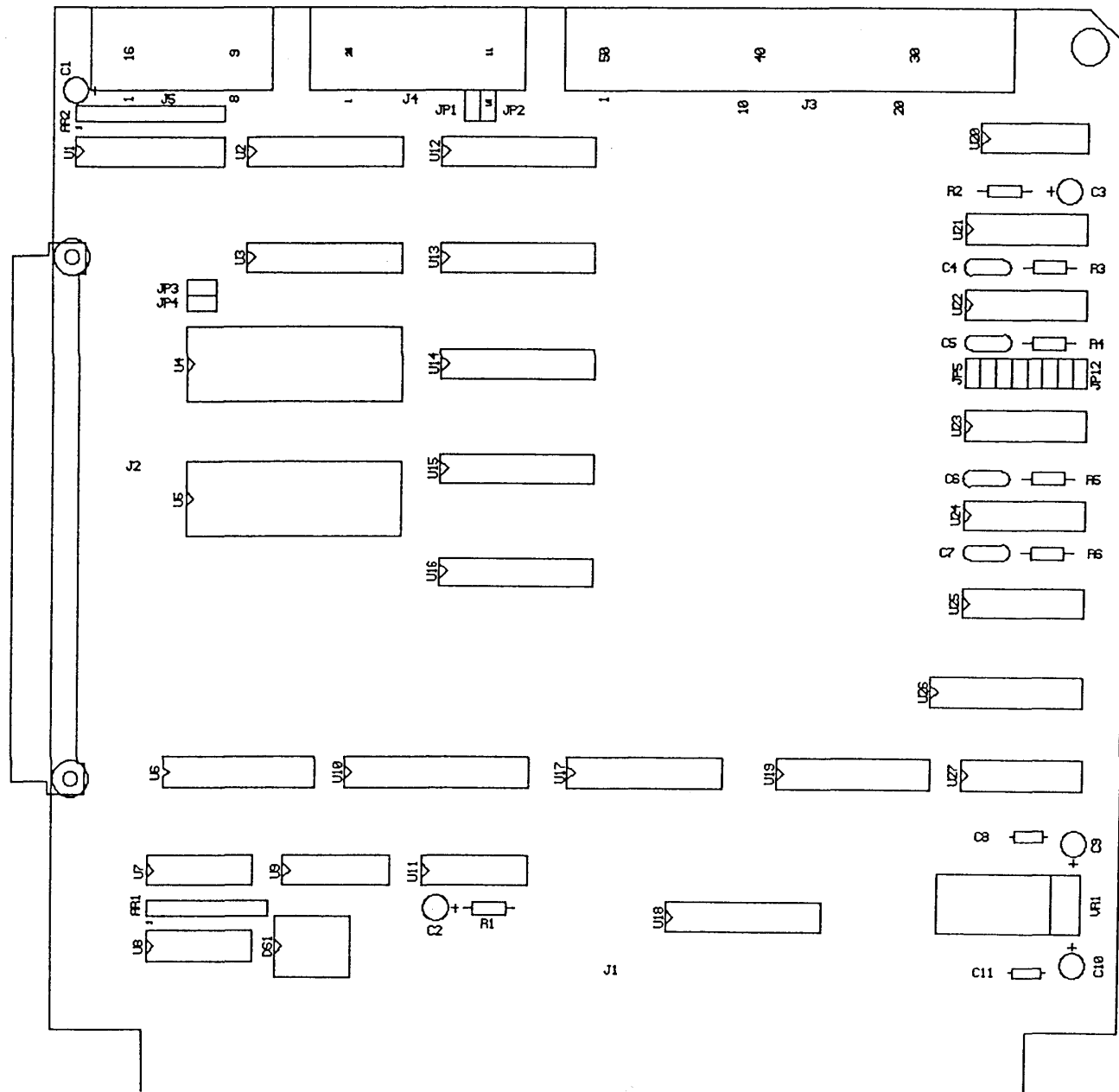
Company Logo		Company Name	
		TITLE	
SERVO CONTROLLER			
APPROVALS	DATE		
DRAWN R. LONG	OCT 29 1990		
CHECKED		DRAWING NO. P1366-B0	SHEET 04 OF 4

4

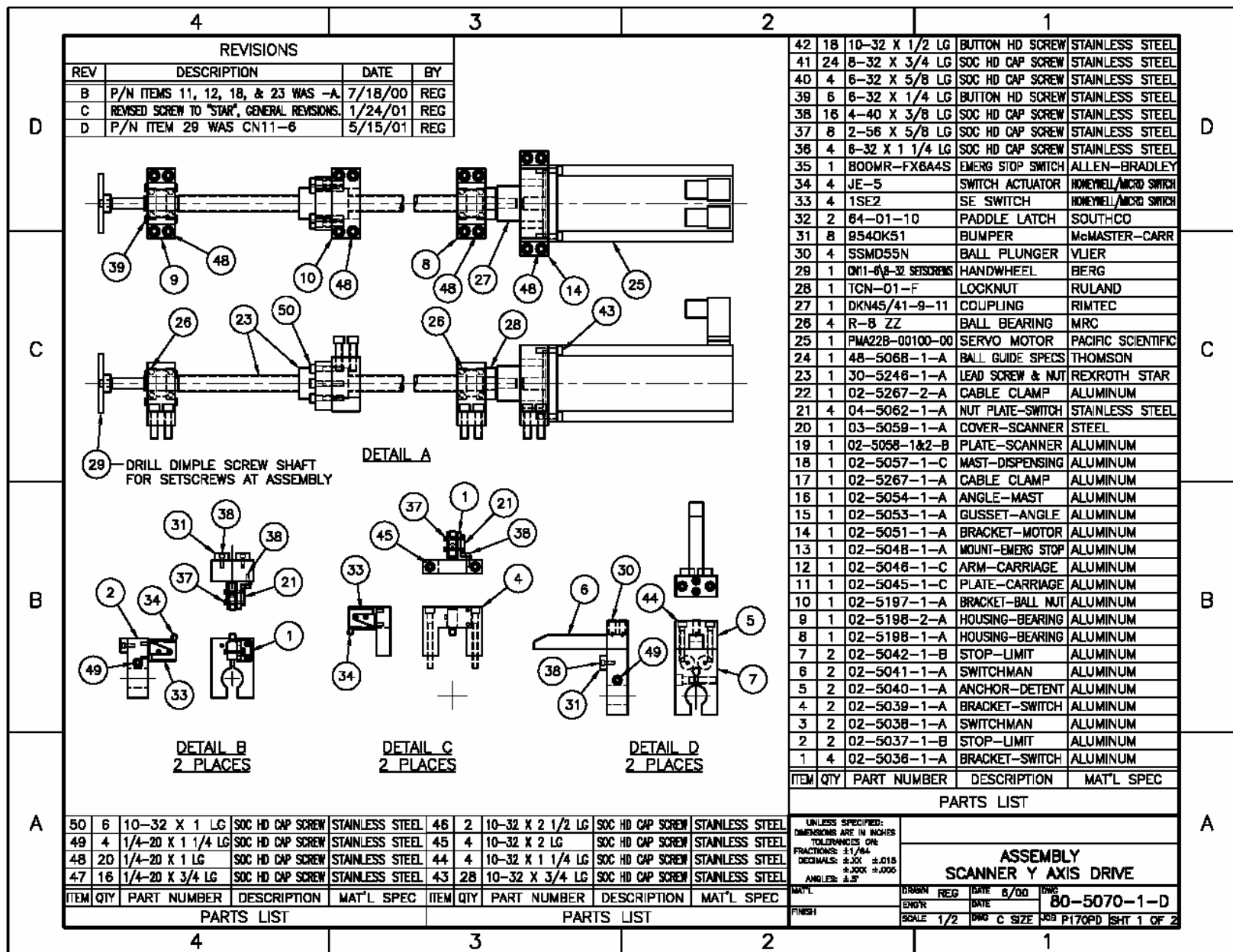
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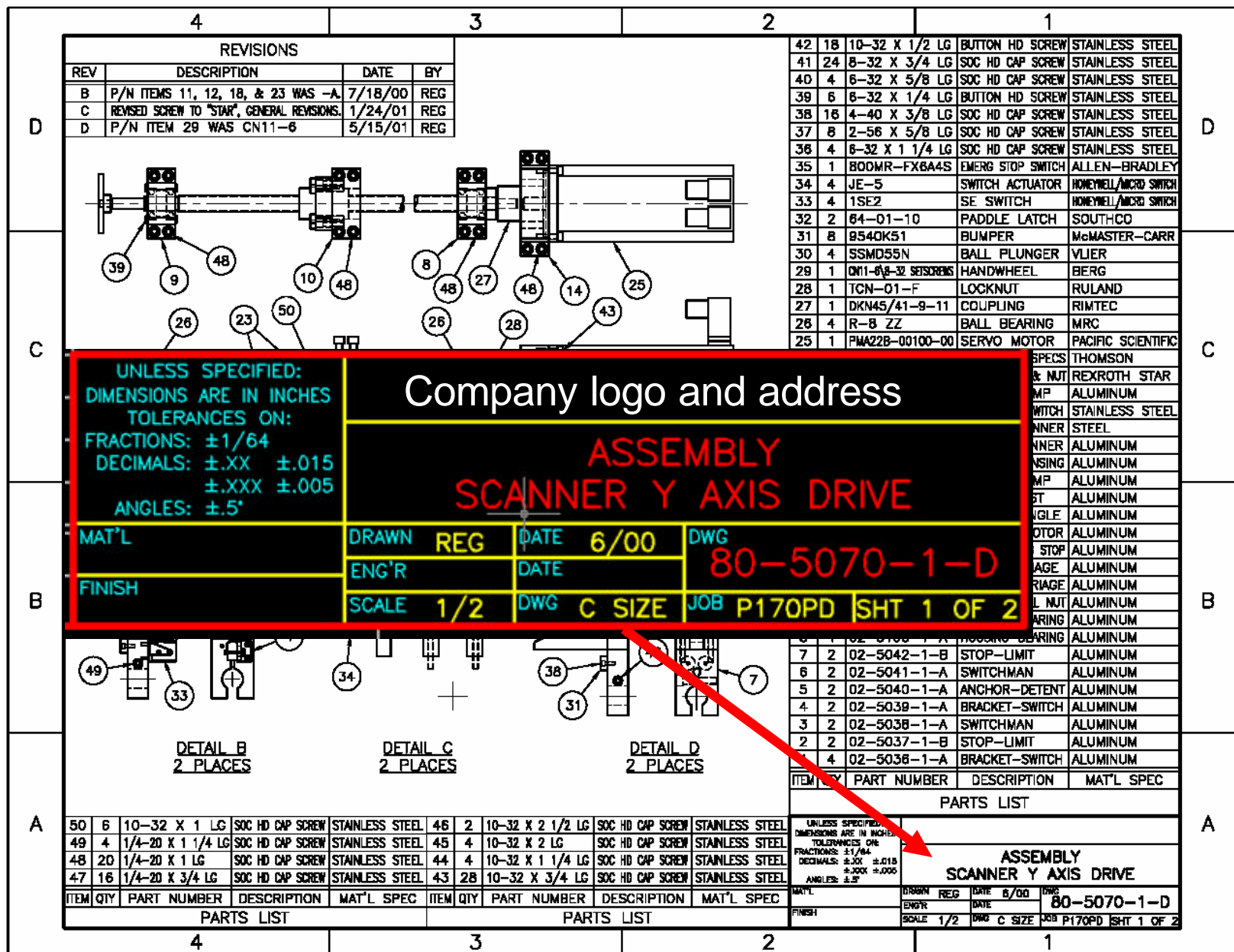
2

1

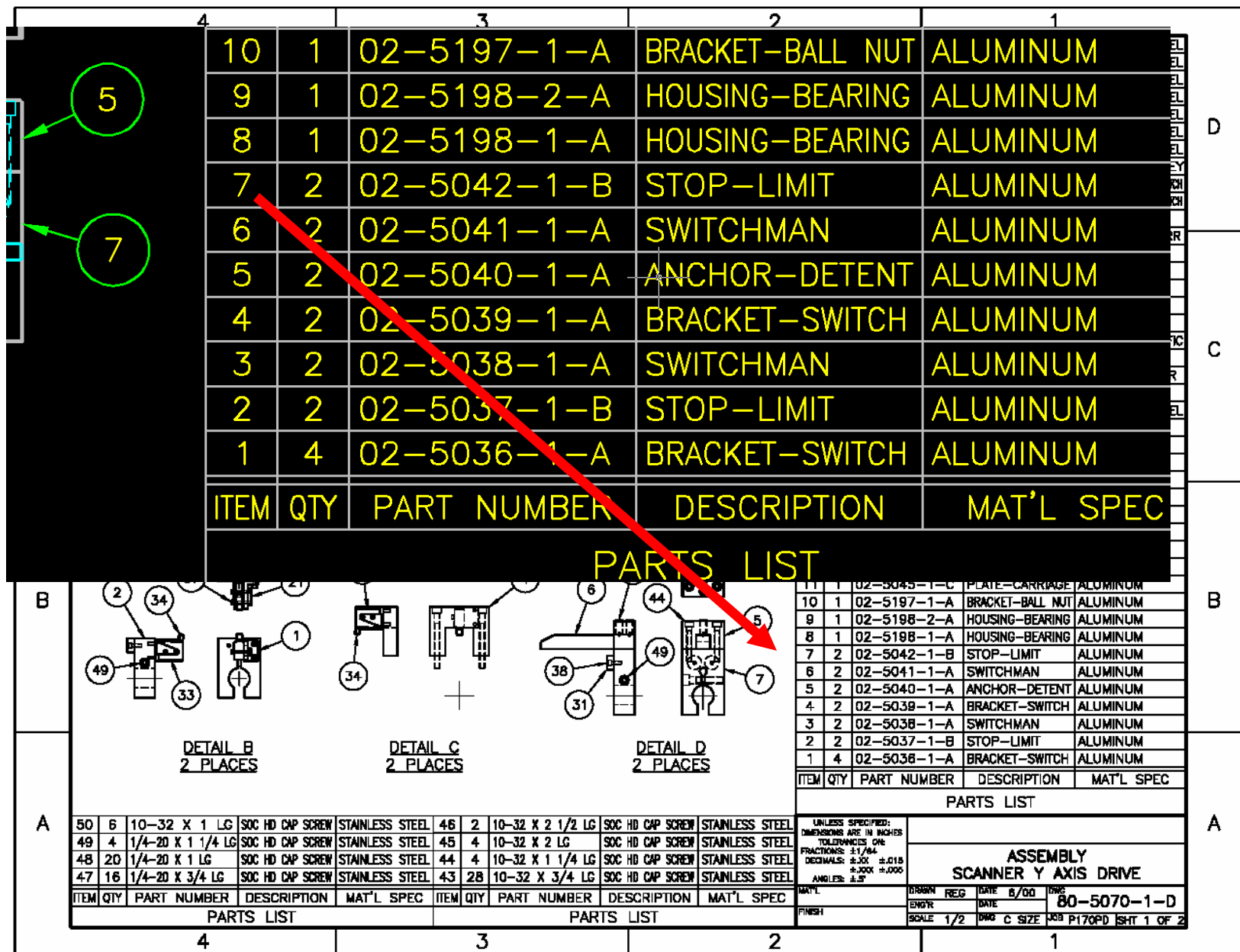


- Physical locations related to unique component identifiers
- Part numbers and component values are often on this drawing (better than separate drawings)

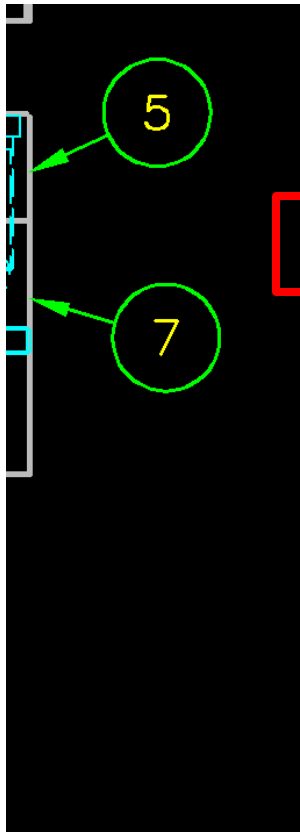






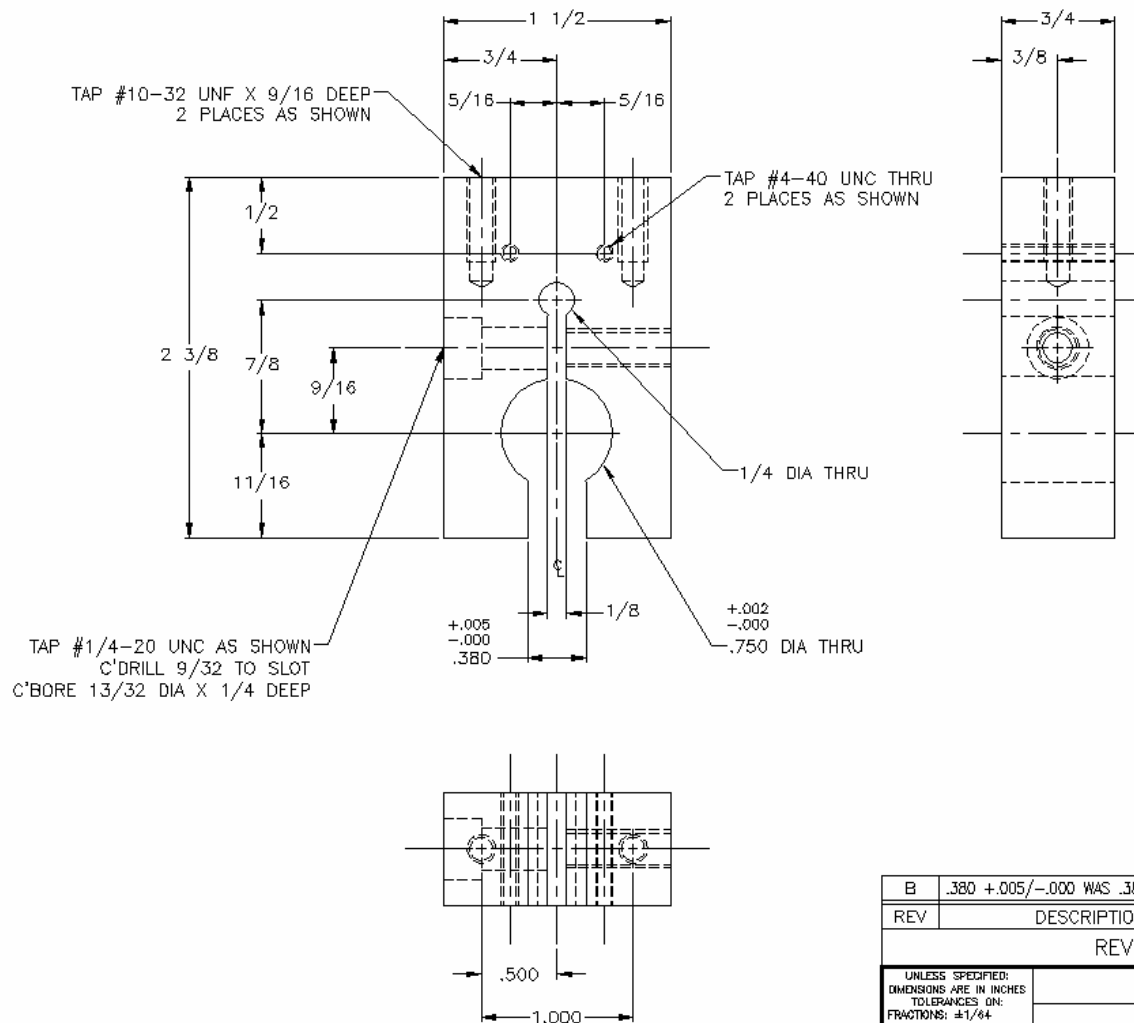


Typical Part Number Block



10	1	02-5197-1-A	BRACKET-BALL NUT	ALUMINUM
9	1	02-5198-2-A	HOUSING-BEARING	ALUMINUM
8	1	02-5198-1-A	HOUSING-BEARING	ALUMINUM
7	2	02-5042-1-B	STOP-LIMIT	ALUMINUM
6	2	02-5041-1-A	SWITCHMAN	ALUMINUM
5	2	02-5040-1-A	ANCHOR-DETENT	ALUMINUM
4	2	02-5039-1-A	BRACKET-SWITCH	ALUMINUM
3	2	02-5038-1-A	SWITCHMAN	ALUMINUM
2	2	02-5037-1-B	STOP-LIMIT	ALUMINUM
1	4	02-5036-1-A	BRACKET-SWITCH	ALUMINUM
ITEM	QTY	PART NUMBER	DESCRIPTION	MAT'L SPEC
PARTS LIST				

Points to Associated Mechanical Detail Drawing



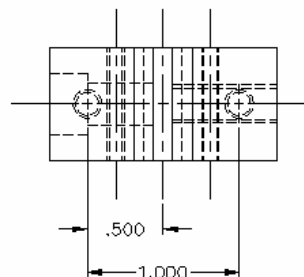
B	.380 +.005/-0.000 WAS .385 +.010/-0.000.	11/6/00	REG
REV	DESCRIPTION	DATE	BY
REVISIONS			
UNLESS SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS: ±1/64 DECIMALS: ±.005 ±.015 ANGLES: ±.5°			
STOP - SCANNER TRAVEL LIMIT			
MATL 6061-T6 ALUM	DRAWN ENG'R	REG DATE 4/00	DWG 02-5042-1-B
FINISH BLACK ANODIZE	SCALE 2/1	DWG C SIZE	JOB P170PD
SHT 1 OF 1			

B	.380 +.005/-.000 WAS .385 +.010/-.000.	11/6/00	REG
REV	DESCRIPTION	DATE	BY
REVISIONS			
UNLESS SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS: $\pm 1/64$ DECIMALS: $\pm .XX \pm .015$ $\pm .XXX \pm .005$ ANGLES: $\pm .5^\circ$		STOP - SCANNER TRAVEL LIMIT	
MAT'L 6061-T6 ALUM	DRAWN REG	DATE 4/00	DWG 02-5042-1-B
FINISH BLACK ANODIZE	ENG'R	DATE	
	SCALE 2/1	DWG C SIZE	JOB P170PD SHT 1 OF 1

TAP #1/4-20 UNC AS SHOWN
C'DRILL 9/32 TO SLOT
C'BORE 13/32 DIA X 1/4 DEEP

+0.005
-0.000
.380

+0.002
-0.000
.750 DIA THRU



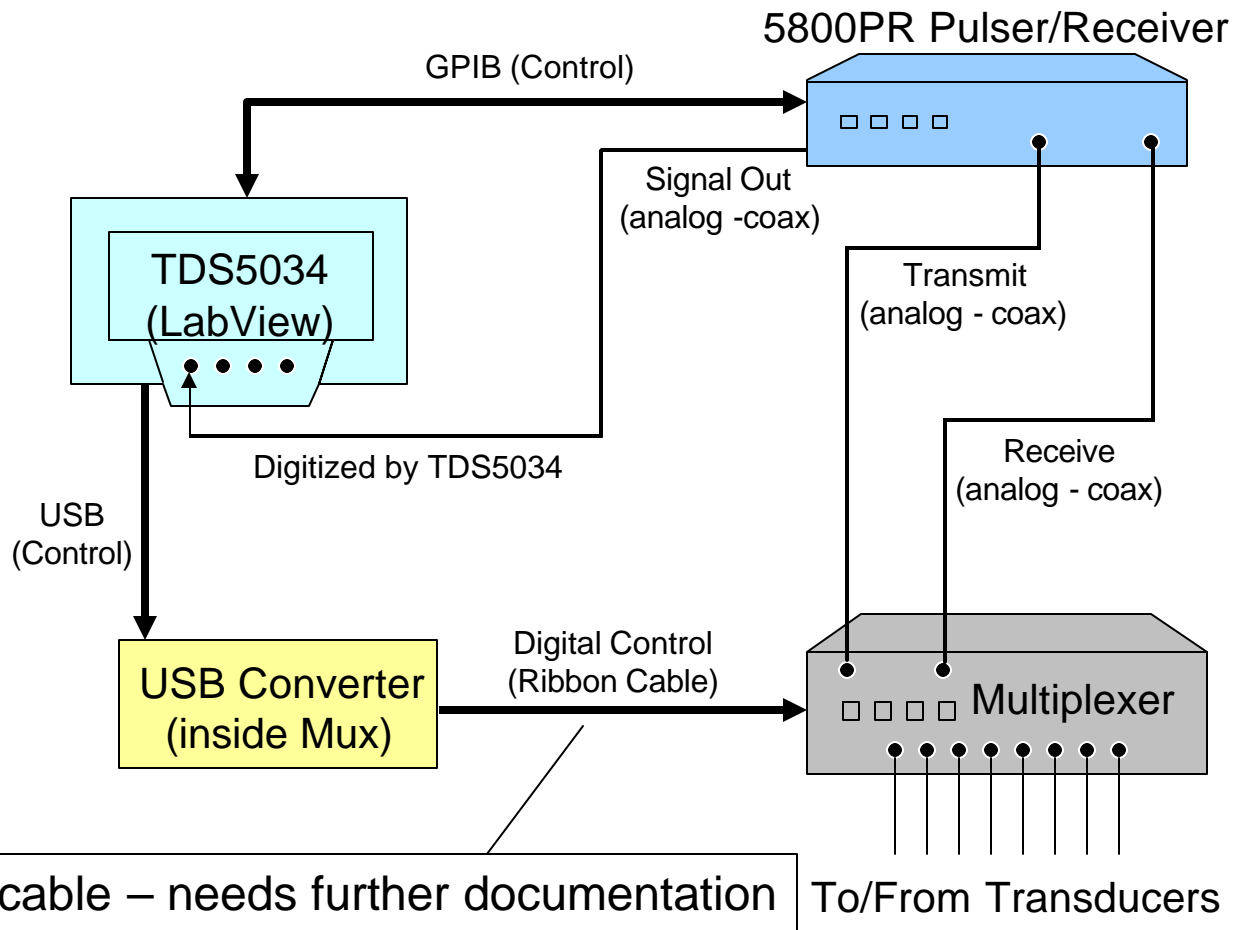
B	.380 +.005/-.000 WAS .385 +.010/-.000.	11/6/00	REG
REV	DESCRIPTION	DATE	BY
REVISIONS			
UNLESS SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS: $\pm 1/64$ DECIMALS: $\pm .XX \pm .015$ $\pm .XXX \pm .005$ ANGLES: $\pm .5^\circ$		STOP - SCANNER TRAVEL LIMIT	
MAT'L 6061-T6 ALUM	DRAWN REG	DATE 4/00	DWG 02-5042-1-B
FINISH BLACK ANODIZE	ENG'R	DATE	
	SCALE 2/1	DWG C SIZE	JOB P170PD SHT 1 OF 1

Interconnection Documentation

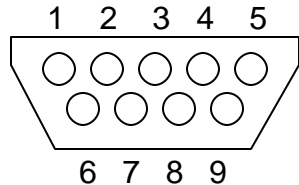
- Interconnections can be internal (e.g., between boards in a chassis) and external (e.g., between instruments in a system)
- No standard way to document interconnections
- Standard cables can be identified by part number and name (e.g., CAT6, USB)
- Custom cables have to be described in detail
 - Drawing showing construction details, and/or
 - Table showing pin numbers and wire colors (if needed)
- Wiring (connections with discrete wires) has to be described in detail

System Block Diagram

Calls Out Interconnections



Example – DB9 to Ribbon Cable



DB9 Header

1	2	3	4	5
10	9	8	7	6

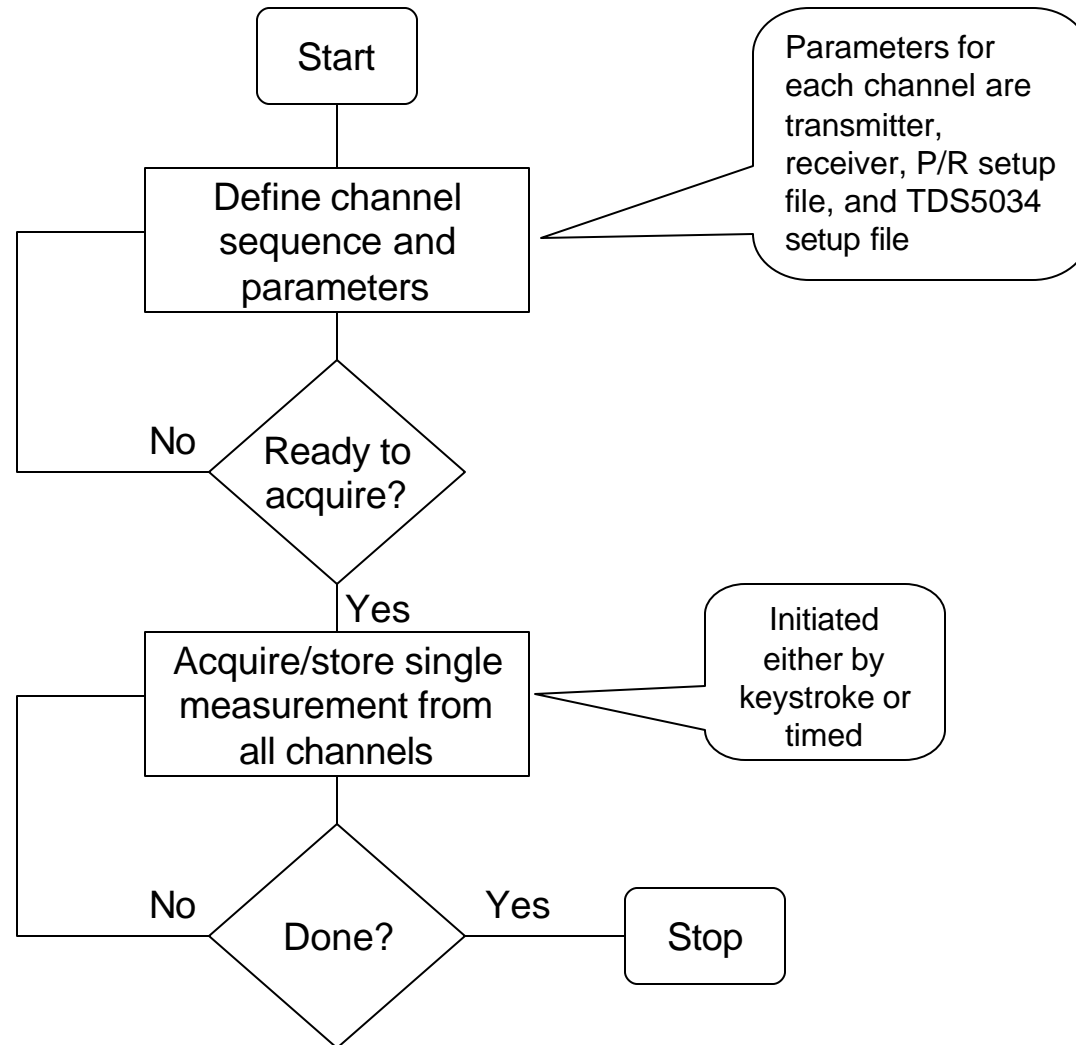
Ribbon Header

DB9 Pin	Description	Ribbon Pin
1	Ground	1
2	+5V	2
3	Data0	3
4	Data1	4
5	Data2	5
6	Data3	9
7	Code0	8
8	Code1	7
9	Ground	6
	Not Used	10

Software Documentation

- Usually a flowchart is useful for helping someone else understand the “flow”
- Also helps the designer figure out how various modules of the software interact
- Software documentation should enable someone else to work on your code
- Well-written and commented source code is absolutely essential

Example “High Level” Flow Chart



Code Examples

- Are revisions identified and described ?
- Is formatting consistent and clear ?
- Are comments are appropriate (not too few or too many) ?
- Are variable names reasonable (descriptive without being too long) ?

Maintain Version and Revision Control of Software

Use a version control software
product such as:

Microsoft Visual SourceSafe

Subversion

Typical Software Version Control Features

- Automatically tracks and controls source code changes.
- Provides sharing and linking capabilities for multiple developers.
- Supports parallel development and branching.
- There are overhead costs associated with using version control software.

General Revision/Version Control

- Most companies follow strict procedures for version and/or revision control after the product is completed.
- Normally required to comply with dictates of most quality assurance systems.
- ECN (Engineering Change Notice)
- DCN (Design Change Notice)
- Keep an index of ECN/DCN numbers

Unique Numbers



Customer Documentation

- User's (Operator's) Manual
 - How does the end user interact with the product?
 - Engineers usually have to write at least some, and often most, of the User's Manual (particularly software engineers)
- Maintenance Manual
 - What does the end user (or the manufacturer) need to know to maintain the product?
 - Engineers usually write this manual
- Many technical writing opportunities for design engineers

Documenting the Design Process

- Laboratory notebooks (or some paper system of recording your design progress)
 - “Work in progress” sketches, schematics, flow charts, block diagrams, etc.
- Electronic files
 - Software source code
 - Drawings and schematics
- Project correspondence
 - Emails, notes from phone calls, letters, etc.
- Other project documentation

Project Correspondence

- Any information transmitted to and/or shared with others that relate to the project.
- Customer letters and emails
- Internal memos and emails
- Keep a posted hard copy file with a file index (Table of Contents) to document important project correspondence
- Important to keep organized and up-to-date

Misc. Project Documentation

- Related research articles
- Vendor information
- Purchasing records
- Meeting notes
- Copies of electronic files



Lecture 10

ECE4007

ECE Culminating Design Project

Preliminary Design Review

2009 September 23